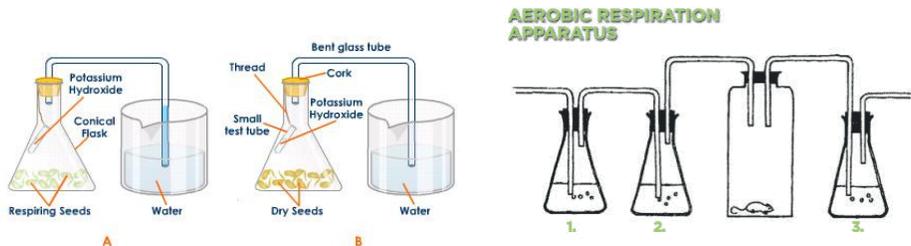


1. **Respiration:** is the oxidation of food substances with the release of energy in living cells. Living organisms need these energy to move, excrete, grow & reproduce.
 - **Aerobic respiration:** is the oxidation of food substances in the presence of oxygen with the release of large amount of energy. Carbon dioxide and water are released as waste products.

Glucose + Oxygen → Carbon dioxide + water + large amount of energy
 - **Anaerobic respiration:** is the oxidation of food substances in the absence of oxygen with the release of small amount of energy. Lactic acid was the waste product which causes fatigue & pain of muscles.

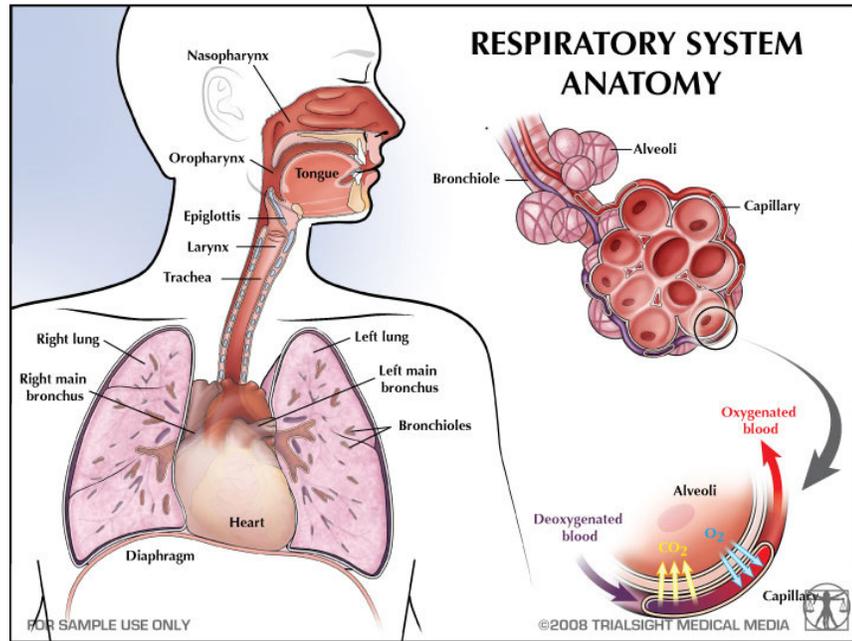
Glucose → Lactic acid + small amount of energy (For animal)

Glucose → Alcohol + Carbon dioxide + energy (For Yeast)
2. **Oxygen debt:** is the amount of oxygen required to oxidize the lactic acid produced in the muscles during anaerobic respiration. Lactic acid is transported back to the liver and converted back to glucose when the body is no longer short of oxygen.
3. Study of respiration of plants and animals

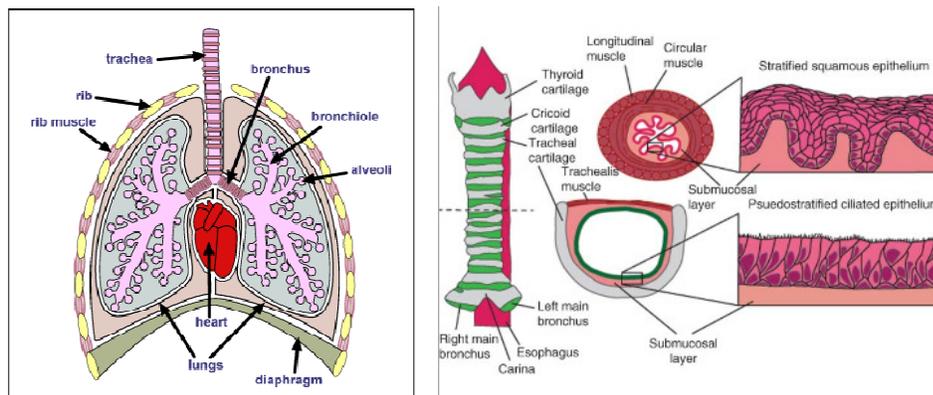


- **Hydrogencarbonate indicator** solution to detect small amount of CO₂ changes.
 - Yellow (acidic due to CO₂ added) → Red (Neutral) → Purple (CO₂ removed)
 - **Sodium/Potassium Hydroxide** solution to absorb CO₂ from air.
 - **Limewater** to serve as indicator of large concentration of CO₂ produced.
 - Clear solution turn to milky white solution when CO₂ added
4. Gaseous exchange in Animals
 - Breathing is the mechanical process to supply the body with the oxygen needed for respiration. Taking in of air is called **inhalation**, giving out of air is called **exhalation**.
 - The lungs are adapted for efficient gaseous exchange by:
 - a. The numerous alveoli or air sacs provide a **large surface area**.
 - b. The walls of alveoli are **richly supplied with blood capillaries**. The flow of blood maintains the constant concentration gradient of gases needed for diffusion.

- c. **A thin film of moisture** cover the surface of the alveolus which allowed the gases (O₂ and CO₂) to dissolved and subsequently diffused into & out of the blood respectively.
- d. The walls of the alveoli and capillary are only **one cell thick** which enable a faster rate of gases diffusion through it.



- The **continuous breathing cycle** maintain a low CO₂ level and high O₂ level in the lung to maintain the concentration gradient needed for gases diffusion. Trachea has a thin epithelium with 2 types of cells:
 - **Gland cells** which secret mucus to trap dust particles and bacteria.
 - **Ciliated cells** with hair like structure to sweep the dust trapped mucus up the trachea.
- The lungs are enclosed by 2 layers of pleural membranes filled with pleural fluid which serves to minimize friction when the lungs expand & contract/



5. Transport of O₂ and CO₂ in blood:
- **O₂** combine with haemoglobin (purplish-red) to form Oxyhaemoglobin (bright-red) for transport to body parts
 - **CO₂** dissolve into blood plasma to form hydrogen-carbonate ion (HCO₃⁻) and transport to the lung.
6. **Breathing rate control: the stimulus for breathing is a high concentration of CO₂ in the blood and in the alveoli air, NOT a lack of oxygen.** Thus, breathing pure oxygen leads to very low breathing rate and is fatal.
7. Negative health effects of tobacco smoking:
- **Nicotine** : (a) is addictive and increases heartbeat and blood pressure (b) Increased rate of blood clots in vessels
 - **Carbon Monoxide**: (a) Toxic by combining with haemoglobin led to reduced oxygen supply of blood (b) Increased rate of fatty deposit in arteries.
 - **Tar**: (a) Contain cancer causing chemicals (b) Paralyzes cilia lining in the air passage.
8. Respiratory system diseases:
- **Lung Cancer** → Un-controlled division of cells producing lumps of tissues.
 - **Chronic Bronchitis** → caused by breathing irritants particles for long period. Signs are:
 - Excessive mucus is secreted by the epithelium.
 - Persistent coughing (cilia on the epithelium are paralyzed thus mucus cannot be removed)
 - Breathing difficult.
 - **Emphysema** → Persistent and violent coughing breaks the partition walls between the air sacs reducing surface areas and making the lungs lose their elasticity. Signs are:
 - Severe breathlessness
 - Chest pain

